Hello!

I am here to introduce you to ‘SkyEcho’. SkyEcho is a Lightning Detector System and an Early-Warning system for Incoming Storms and the accompanying Lightning Strikes.

- <u>Why is this Idea Significant:</u>

  Every year, India loses over 2,000 lives to lightning. Many of these include farmers and children in rural areas. SkyEcho provides them with a local, offline, affordable early-warning system.

- <u>How I stumbled upon the Idea:</u>

  I stumbled upon this idea when I was playing around with a AM Radio during a thunderstorm on 17th of July, 2025 in my city. I noticed these weird spikes in the Waveform that i was recording from the Audio, I searched more about it and found out that these are called ‘Sferics’ I used ‘Audacity’ software to record and visualise these Sferics. Here’s a Spectrogram view of such Sferics against the Background Noise:

  (Top: Wideband spectrogram showing sferic pulses; Middle: Time-domain signal; Bottom: Narrowband spectrogram highlighting VLF burst)

- <u>Scientific Concept Behind the Idea:</u>

  Sferics (short for atmospherics) are brief electromagnetic pulses, majorly caused by lightning strikes, that propagate as very low frequency (VLF) (3-30 KHz) radio waves through the atmosphere.

  SkyEcho uses VLF Antennas/AM Radio Antennas, Filters and a MicroController to detect these Sferics and judge the severity of the storm. (Filters Prevents False Alarms)

- <u>How it will be Implemented:</u>

  This system can be installed on a 2-3 meter long mast in villages and lightning prone areas to detect Incoming Storms from Tens of Kilometers away (As these Sferic pulses bounce off of the Ionosphere and propagate very far). This can save many lives that are lost every year due to Lightning storms and can even work as an early warning system that can alert people to seek shelter before a storm comes.

  A microcontroller counts these pulses and triggers **Three Alert levels** with LEDs and a Siren.

  Here are the Alert Levels and what they mean:

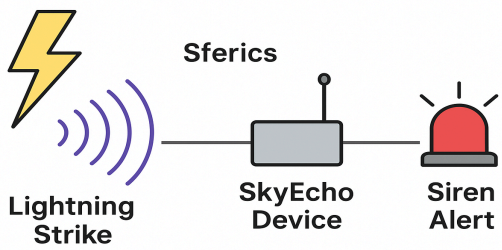
  Green: Normal conditions.

  Yellow: Possible storm approaching (moderate Sferic activity). A Bright Yellow LED is activated to indicate this

  Red: Storm imminent — continuous siren, people must seek shelter immediately.

  (These levels of warning will be judged by the MicroController by counting Sferics in a particular Time-Period.)

A Basic Diagram Showing the Basic Working of SkyEcho:



- Features and Cost:

  SkyEcho works without any External Power (Works on Solar Power), Uses no Internet Connection, Detects the Proximity of storms and alerts people if a Storm is approaching them, It is a Low Cost Solution to Storm Detection.
  This system can be easily implemented in Rural Areas with Minimal Costs. The only requirements are:

  A Self-Made VLF Antenna (Approximately ₹500); A MicroController (₹500 - ₹1000);
  A Solar Panel (Approximately ₹1000); A Battery Pack (₹500 - ₹800); A Siren (₹500);
  Extra Essentials (Like Voltage Regulators, VLF Front-End Parts, Filters etc) (₹1000 - ₹1500)
  The total cost of one unit would approximately be ₹4,500–₹5,500, making it affordable for schools, Panchayat offices, and village markets

My Goal with SkyEcho is to provide an Efficient and Accessible (Low-Cost) Solution for Early Storm Warning to save lives and property.

NOTE: SkyEcho is only able to measure the Proximity of a Storm and not the direction from which it is approaching

IMPORTANT: SkyEcho is not a Lightning Hazard, As it uses a High Impedance Antenna mounted below the roof line, It also includes Surge Protection in the Antenna Output lines with proper Earthing done to ensure safety. Clear Do's and Don't will also be printed on the device itself.

Thank You!